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Journal of the Society of Arts.

FRIDAY, JUNE 13, 1862.

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INTERNATIONAL EXHIBITION OF 1862.

SEASON TICKETS.

Members of the Society and others are informed that Season Tickets may be obtained at the Society's house, on application to Mr. S. T. Davenport, the financial officer. Price three guineas and five guineas, the latter also admitting to the Horticultural Gardens and *fetes* during the season.

GUARANTEE.

The Council beg to announce that the Guarantee Deed is still lying at the Society's House for signature, and they will be much obliged if those gentlemen who have given in their names as Guarantors, as well as others interested in the Exhibition, will make it convenient to call there and attach their signatures to the Document. Signatures for sums amounting in the aggregate to £451,900, have been attached to the Deed.

ELEVENTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS.

The Eleventh Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on Monday, the 23rd inst., at 12 o'clock, noon. Sir Thomas Phillips, Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, *as soon as possible*, to the Secretary of the Society of Arts, the names of the Representatives appointed to attend the Conference, stating at the same time, if possible, whether those gentlemen will also be present at the Society's Annual Dinner, which will take place on the following day, and of which particulars are given below.

The Chairmen of, or Representatives from, the Local Boards of Examiners are invited to attend.

The Council will lay before the Conference:—

1. The Secretary's Report of the Proceedings of the Union for the past year.
2. Report of the Society's Examinations for the present year, and the Programme of the Examinations for 1863.
3. The Report of the Examinations of the Central Committee of Educational Unions instituted last year.
4. The new List of Lecturers, printed in accordance with the wish expressed on the last occasion, as well as a List of Subjects suitable for Discussion Classes in Institutions.

The following subjects are suggested for discussion:—

5. Whether arrangements can be made to enable Excursion Parties of Institutions in Union to visit the International Exhibition on some day or days to be agreed upon.
6. The propriety of directing the attention of the Committees of Mechanics' Institutions to the best means of rendering them places not only of instruction but of rational amusement for their members. In this would be included the question of providing refreshments.
7. The question as to the length of the periods for the payment of Subscriptions to Institutions, whether half-yearly, quarterly, or at shorter intervals.
8. The attention of Institutions will be called to the importance of establishing, from time to time, Special Local Exhibitions and Local Museums, by means of the efforts of the inhabitants of the various districts.
9. The expediency and means of establishing Competitive Exhibitions by Artisans of their works of skilled labour.

Notice of any other subjects which the Representatives may wish to submit to the Conference, should be given to the Secretary of the Society of Arts.

ANNUAL DINNER.

The One Hundred and Eighth Anniversary Dinner of the Society will take place in the Refreshment Room over the Central Entrance from the International Exhibition Building to the Horticultural Gardens, on Tuesday, the 24th inst., at half-past five for six o'clock punctually. The Right Hon. W. E. Gladstone, M.P., will preside.

Applications for tickets (price fifteen shillings each) should be made to Mr. S. T. Davenport, at the Society's House; and it is particularly requested that those who intend to be present will take their tickets as early as possible in order to facilitate the arrangements.

CONVERSAZIONI.

The second and third Conversazioni of the present season will be held at the South Kensington Museum, on the 9th of July and the 8th of October.

WHAT IS GOOD IRON, AND HOW IS IT TO BE GOT?

(Concluded from page 466.)

In a time of depressed trade the wrought-iron manufacturer has an opportunity—which it might be thought he would not miss—of buying the best pig-iron at a cheap rate. But he himself is the first to feel the pressure. It is the demand for wrought iron that slackens in the first instance; and, whatever be the evils which excessive competition occasions by holding out temptations to economise in quality, they are greatly exasperated by the struggles of a declining trade.

Such a time of depression is the present. It commenced with the American failures and the monetary crisis of 1857, and continued with increasing severity till the beginning of 1859, when the market showed symptoms of recovery. But the French Emperor's declaration of war against Austria destroyed confidence and paralyzed commercial enterprise throughout Europe; and subsequently the American tariff deprived the English manufacturer of the chief foreign outlet that was left. It is to be hoped the depression has reached its lowest point. Prices can hardly be lower, but it is only too possible that more furnaces may be blown out, and more firms forced out of the trade. The large orders of Government for armour plates and other articles for which a superior quality of iron is confessedly required, ought to have given an impulse to the market, so far at least as to increase the demand for the best iron, of which the supply is so very small; but this is not the case, and the inference is irresistible, that the manufacturers do not employ the best iron. It might, indeed, be supposed that the mere anticipation of a general recognition of the need for first-class iron would produce some effect on the market; but the discouragements of long continued depression deaden all commercial energy. At such a time speculators fear being too soon rather than too late in the field. Each man hopes not to be last in a race in which as yet no man has started, and he hesitates to make the first move. All as yet remains motionless.

This, then, is the paradoxical condition of the iron-trade, which we have endeavoured to explain by tracing the steps by which it has been reached. No blame is imputed to the manufacturers as a body, who have only obeyed the laws which regulate all commercial transactions. It would be foreign to the purpose to note the struggles of individuals who have held a course in opposition to the current of the times: we have to deal only with general results. On the one hand we see a rapid declension in the use, and therefore in the production, of first-class iron; involving a complete change, material and moral, in the iron-trade. On the other hand, we find a reaction in favour of the best iron, which, though real, has hardly yet advanced beyond words. The public have discovered that, for certain purposes of great importance, the substitution of cheap iron for good is a failure, but the pressure on the manufacturers is not yet sufficiently strong to divert them from the policy and practice of years; and hence it is that, amidst all talk about first class iron, the demand for it has not increased. This circumstance is favourable at least to those who desire to be purchasers. But it is scarcely possible that Government should avail itself of the opportunity. No Government can act with the energy and decision of an individual trader. It lacks central motive power. It is a huge giant, rendered helpless by the feeble and defective action of the heart. The question is not only, What Government ought to do? but, How much can it do of what it ought?

Its first active step was highly judicious. More than a year ago it appointed a Commission, composed of men well known to the world for their scientific attainments, their practical acquaintance with the manufacture of iron, or their knowledge of the requirements of the naval and military services, for the purpose of collecting such information as it will need for its guidance as one of the greatest consumers—or it may be one of the greatest manufacturers—of iron in the country. No measure could be better advised to restore confidence to the manufacturers—with whom, for reasons to be referred to presently, Government had become unpopular as a customer—and to give in some degree to Government itself the knowledge and the confidence necessary to act with decision.

But, however valuable may be the labours of the Commission in investigating the points to which their attention is specially directed, no more important service can be expected from them than the revival of those elementary truths the neglect of which has caused, and still threatens so much mischief. Nothing short of such an authority is needed to re-establish the fundamental axiom already mentioned, that "in every stage of the iron manufacture, from good materials alone can first-rate quality be produced." Nor less important is its corollary, that "The quality of the materials is a necessary guarantee for the quality of the produce." The best materials, indeed, avail little without the skill to work them, but nothing good can be made from bad materials, however skilfully combined and worked.

The reader knows already what are the best kinds of pig-iron; the operation of manufacturing them into the best wrought iron may be made intelligible in a few sentences.

The second process in the iron manufacture, which is the most delicate and difficult of the whole, is called "puddling," because the operator or "puddler," manipulates the liquid metal in a small furnace, much as the labourer kneads the clay and water to form an impervious substance. In the first place, a judicious selection of the best pig-iron must be made. But, before proceeding, it is desirable to clear up an ambiguity which clings to the word "best" as applied to iron. So many are the uses of iron, that no iron is the best in the sense of being the best for *all* purposes; but, in common parlance "best," used generally, denotes the first-class iron—the grey cold-blast, including all its various denominations applicable to different uses, and bearing different prices; "best" used with reference to a special purpose, means that denomination of first-class iron most suited to that purpose. In the present case it does not imply the more expensive denominations of the cold-blast pig-iron, which are reserved for the manufacture of the highest class of machinery, but the "grey-forge" and the strong-forge," which are specially adapted for the operations of the puddler. It is not desirable that the iron selected should be all of the same make—for the best makes are in most cases improved by intermixture—nor even that it should be exclusively of "cold-blast." Small quantities of certain kinds of "hot-blast" may be combined, so as to improve the quality of the compound; and in the knowledge of these mixtures lie the art and the secret of the forge-manager. When the pig-iron thus selected is put into the furnace, it is "boiled;" and in the course of this process (which it is unnecessary to describe in detail) it casts off its impurities in the "cinder;" hence it is obvious why this cinder, if thrown again into the smelting furnace, must damage the quality of the produce. If any part of the "charge" remains unmelted when the bulk of it is ready for working, the "ball," or conglomerated mass of white-hot iron into which the labour of the puddler works the molten metal, is unfit to be subsequently manipulated into the highest class of wrought iron. Care also must be taken that the fuel employed should be the freest from sulphur that can be procured; and the "fettling" of the furnace, as it is called—that is to say, the arrangements made to protect it from the action of the liquid metal—should be of the best kind.* The white-hot ball just mentioned is taken out and subjected to the action of an enormous hammer, and while still red-hot is drawn out by means of "rolls" into bars or billets. It is now called "puddled iron," and is considered to be in a *half-manufactured* state; but when made of the materials and with the precautions just mentioned, it is already more advanced than is generally believed. We have seen a wire of the size of a thread which had been drawn from a rod produced direct from a puddled billet in the mill, and to such iron as this any degree of quality that is desired may be given by further manipulation.

But it is only to the best iron that fresh virtue is imparted by repeated working, and there is at last a limit beyond which even the best can endure it no longer. The prevailing notion that *all* iron alike is improved by manipulation is doubtless derived from the traditions of the old time, when all iron was produced by the cold-blast; and it has survived the state of things which once made it true. In the present condition of the manufacture it has led to ruinous mistakes. Inferior iron very soon attains the point after which it loses by being again subjected to the action of the fire; and by the time it has reached the stage of "merchant bar" it cannot be worked further with advantage. Here, then, is an easy practical rule for the manufacturer's guidance. When he needs iron for any purpose that implies repeated workings of the metal, he only prepares disappointment for himself or his customers if he is induced to employ any but the best quality.

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*No positive rule can be laid down as to the best kind of "fettling." Each district has its own method, which is probably the best suited to the materials. The point is one of great importance, as it seriously affects the quality of the iron.

For the present purposes of Government it will be universally admitted (in words at least, if not in practice) that none but the best iron can safely be used. But there is another point of great practical importance, on which there seems to be a want of clear understanding between the Government and the contractors. The best iron may be so manufactured as to be endued with the different properties of either hardness or toughness as its distinguishing characteristic. The greatest degree of hardness of which iron is susceptible cannot co-exist with the greatest degree of toughness which, by a different mode of manipulation, might be given to the same piece of metal. Hard iron, even the very best, must to a certain extent be brittle. Tough iron gives up a portion of its hardness to retain its tenacity. If to samples of hard iron there is applied a test to prove their sharpness, they will probably be found defective. But it by no means follows that the iron thus rejected is necessarily of an inferior quality.

In the first instance then, to save time, money, and disappointment, it should be made clear whether toughness or hardness is the quality required. If, for example, it is intended to replace the cinder rails, which are splitting, and crumbling away on many of our principal lines, it is plain that in constructing the new rail the surface part of it cannot be made too hard; but the lower part should be tough, in order to bear the prodigious strain to which, both laterally and vertically, it is subjected. It is accordingly proposed to make the "head" as it is called, of "steely" iron, but the lower part of the rail of tough iron of good quality.* The same device has already been adopted for the best tires. The outside of the tire is made of a quality approaching to steel, but the inner portion nearest the wheel is of the best tough iron.

In the iron for armour-plates it is understood that the highest authorities, both practical and scientific, concur in opinion that toughness is the quality to be aimed at, and in that case the best "puddled bars" are the only proper material. If, indeed, it is desired to make a *hard* plate, scrap-iron, which is cheaper than puddled bars, is well adapted for the purpose. But it is a point of the greatest importance—the misapprehension of which would cause serious mischief—that only the best scrap-iron should be employed. The term "scrap" has reference to form only, and it must not be assumed that fragments of good iron and fragments of bad are equalized in quality because they are identified in name. The best scrap-iron consists of the fragments collected from the workshops of the smiths and the boiler-makers, who do not use the inferior qualities of iron. It is cheaper than the puddled bars, because it is the remnant of a manufacture which has already made its profit, and because it is applicable to only a limited number of purposes. Between the best scrap-iron and the best puddled iron the difference is not in the original quality, but in that which has been imparted by further manipulation: the scrap-iron, having already been so frequently worked, becomes hard, and to a certain extent brittle, by the complicated process of the armour-plate manufacture, throughout which the puddled iron retains its fibrous texture and its toughness.

But if under the name of scrap-iron are swept off the miscellaneous contents of the marine-stores, of unknown quality, varying from the best to the very worst, of unequal sizes, and coming to the welding-point at different temperatures; and, above all, if "old rails" are smuggled in under a new name, the question between scrap-iron and puddled bars is no longer one of manipulation only, but also of quality.

If scrap-iron is employed to any extent, it is hard to say what precautions would suffice to prevent use of the improper kinds. The supply of best scrap-iron is altogether insufficient to meet a large demand. Old rails —which are almost universally made of cinder-iron—may be had at 20s. less than the best scrap-iron, and 40s. or 45s. less than puddled bars. Cinder-iron is an element of weakness wherever it is introduced. It is not turned into good iron by being broken small, and it is only made worse by further working. It would be as hopeful to find the philosopher's stone and turn cinder-iron into gold as to work it into an efficient trust-worthy armour-plate.

Among the many experiments which it is understood have been tried at the arsenals, there remains untried one which well deserves consideration, and may lead to important results. It is most desirable to ascertain the effect of armour-plates made of puddled bars; and the experiment involves no preliminary expense. At Portsmouth and elsewhere there are the hammers and machinery necessary for forging the plates; it only remains to secure puddled bars of the best quality, and on this point there is no fear of being deceived; for, however difficult it may be to *make* the best puddle bars, the process by which they are *tried* is simple and intelligible. It is merely necessary to strike them with a heavy hammer so as to bend the extremities, *both when red-hot and when cold;* for iron destined to make plates should stand both these opposite tests: not, indeed, because an armour-plate is ever to be made red-hot, but because the iron, if not of a quality to be pliable when heated, will not retain its toughness throughout the workings which it must undergo before it is formed into a plate.

By the course proposed, the Government also would secure the advantage of comparing the expense and efficiency of its own hammered plates with the plates, both hammered and rolled, of its contractors: and moreover it would be much assisted in deciding the great practical question whether the State should turn manufacturer on its own account; that is to say, whether it should buy the pig-iron, and then carry on all subsequent operations at its own works. The security as to the quality of the iron, the very great economy of saving the contractor's profit, and the independence of action which would be obtained by such a plan if it were ably carried out, are advantages of the utmost importance. But, on the other hand, the heavy preliminary expense, the long delay of preparation, the possible loss and discredit of failure, are formidable objections. The one great difficulty, however, is to find, at first and for every part of the operations, competent management and competent superintendence of that management. It is said that the foundry at Woolwich was constructed on the most approved plan, and was conducted by managers of zeal and ability; but in one point there was a deficiency—there was a want of knowledge of the pig-iron manufacture and of the trade. The managers bought ordinary iron, such as is sent into the market for ordinary purposes, and they analyzed and tested, they broke and they twisted, and, finding none that came up to their standard, they jumped to the hasty conclusion that cast iron is unfit for ordnance.* Had they called in the aid of competition, and invited iron-masters to send specimens of iron specially manufactured for ordnance purposes, they would, it is believed in the "trade," have procured a material approaching nearer in toughness to wrought iron than would at present be thought possible, and at a cost which (whatever price may be put on the specially manufactured iron) would have been trifling in comparison with the expense of the wrought-iron ordnance.

The failure of this experiment—which seemed so hopeful, and which so nearly succeeded—naturally raises fears for another experiment of the same kind, but on a much

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*** It has been much disputed whether the two qualities of iron can be satisfactorily welded together, but the difficulty has been overcome, and there is no doubt but that an efficient and durable rail might be thus manufactured at a reasonable cost.**

*** The American method of casting ordnance hollow is said to be well worth our own consideration.**

larger scale, and of much greater difficulty and greater risk. The proposed plan offers a middle course. By hammering their own plates with such machinery as they have now at their disposal, the naval and military Boards will incur no loss if they afterwards abandon the design of manufacturing; and if, on the other hand, they persevere in it, they will gain by this previous essay the knowledge and the confidence to proceed. If a plan so vast as the establishment of Government manufactories of iron for all naval and military purposes is ever to be successfully executed, it can only be done by expanding it gradually, and making sure of one step before another is hazarded. Time is needed to find, and experience to form, the men who are to carry it out. If the experiment of hammering plates is attended with success, the Admiralty may be tempted to lay down mills for rolling them and for other operations; but till its managers become very dexterous and expert as iron masters, it would do well to avoid the operation of "puddling," and to continue to purchase puddled bars. In times of prosperity there is little of puddled iron in the market, as the manufacturer needs for his own use all that he makes, but at present the Government would have no trouble in procuring it; and, if the demand were likely to be permanent, forges would soon be constructed for the express purpose of providing the supply required.

Till the State turns manufacturer, there remains to be solved the great problem how to secure from contractors an article of the best quality in exchange for the best price. It is found by experience that the presence of a Government Inspector at the works is utterly insufficient for the purpose. A paragon of integrity and ability, possessing all the knowledge of the most accomplished ironmaster, and gifted with the eyes of Argus and the vigilance of Cerberus, without his taste for a sop, would be unequal to the task, unless he were endowed with powers of ubiquity; and, if at last the execution of the contract is unsatisfactory, the Government is debarred from remonstrance or redress, as each step in the process has been sanctioned by its own inspectors. It would be better to substitute for the continuous inspection of a resident agent the occasional visits of a person higher in station and authority, whose business it should be to come at irregular intervals and without notice, to inspect the work and the materials, and to transmit specimens of both to be subjected to the appropriate tests, both chemical and mechanical, and also to look over contracts and invoices, and satisfy himself that the materials are in accordance with the spirit of the contract. In this there can be nothing offensive to the manufacturer. This mode of inspection exacts from him nothing more than the presence of a resident agent was intended to secure. Inspection of any kind implies want of confidence: there is no additional offence in making the inspection an efficient one. Truth has no aversion to daylight. Government, in this instance, has not shown itself one of those unreasonable customers who haggle for price, and expect impossibilities. It has ascertained that for its present purposes the best materials are required. It has agreed to a price which amply covers the cost of the best materials; and assuredly it may claim the right—or rather is bound to acknowledge the duty of ascertaining that the best materials are actually employed.

If the present preparations for national defence are carried on, it is manifest that, either as manufacturer or consumer, and more probably both, Government will for some time to come have very extensive dealings with the iron-trade. But unfortunately the regulations of the public offices are ill suited to such a conjuncture. Strict rules are undoubtedly necessary to prevent public business being hindered by the caprice or dishonesty of contractors, and the endless intricacies of form and routine have been introduced as the best safeguards against corruption; but they impede the intercourse with the manufacturer, and they paralyse the action of official Boards to the most mischievous extent. Some time ago an advertisement appeared in the *Times* inviting tenders for supplying the Admiralty with "melting" iron. On application at the office it was found that tenders were wanted only for the supply of the iron of two specially-named firms! Probably no one is to blame for this absurdity. The board could not throw the matter open to real competition, for there was no one to take on himself the responsibility of deciding between the competitors; they could not send an order direct to the firms in question, as any private company would have done, for there was no one to take on himself the settlement of the price. Not to incur responsibility must of necessity be the limit of every subaltern's ambition. If he steps beyond this, if he attempts to benefit the public service beyond what is written, he has to encounter ridicule and obloquy from his equals, and is not always rewarded by encouragement from his superiors; he has no resource but to shelter himself behind precedent, and take refuge in unchangeable routine. The regulations which insist that samples for trial shall be paid for by the manufacturer, and many other galling pretensions which could be set up by no other customer, save in reality nothing to the public, and place the Government in a position of great disadvantage. Manufacturers complain that their work is in many cases submitted to incompetent judges, who decide without appeal; and delusive competition, established merely to avoid official responsibility, deprives the Government of all the advantages which a real competition would secure.

The object to be attained is to confer on Government powers as nearly as possible approaching to the freedom of action possessed by a private firm, without unduly relaxing the restrictions which must be imposed on a public office; and to place its relations with the market as far as possible on the same easy footing as those of every other trader. All schemes which have been devised for this purpose resolve themselves into the appointment of an officer or a board, with varying devices for securing the honesty and capacity of these new officials. The objections to such a plan are many and weighty, and the time is not yet come when the Government could be induced to adopt it, or indeed would be able to carry it through Parliament. But at least palliatives may be applied. Heads of departments might do much by examining into details which are not usually brought before their notice, and by revising the rules of their respective offices with reference to purchases and contracts for iron. Without forgetting that they are Ministers of the Crown, let them consider what should be their course if they were the chairmen of great trading companies. Great companies, it is true, are often encumbered with many of the difficulties of routine which beset the offices of the State; but to a different degree, or their business would come to a standstill. Government may be assured that the impediments with which it has surrounded itself are very repulsive—never else could so much unpopularity have attached to a customer whose credit is so good and payments so regular.

Above all, the Government wants agents who possess the information which every individual similarly situated would require for the protection of his interests. As a mode of providing such for the future, it might be advantageous to encourage some of the many intelligent officers in the service of the various departments to acquire a practical knowledge of the iron trade, to the extent of learning the products of the different districts, the properties and qualities of the various makes of iron, the theory of intermixing them with the best effect—in short, to gain a general acquaintance with the nature and management of the various processes of the manufacture. To this might easily be added the study of chemistry and mineralogy, so far as they bear on the production and working of iron. All this would be but superficial information, if they were to turn manufacturers on so slender a stock; but thus instructed they would be intelligent negociaters in all dealings with the iron-trade, and they would relieve their respective boards of the helplessness and distrust—the necessary consequences of ignorance—which have so much impeded the transactions of Government with its contractors.

Never before did there occur an instance in history where a matter of commercial and manufacturing policy assumed such gigantic importance as belongs to the iron question at the present moment. If, a quarter of a century ago, a political economist had been asked to name the conditions most favourable to the security and prosperity of the country, he could have devised nothing more promising than that supremacy in commerce and in war should be made dependent on superiority in the manufacture of iron; that iron should be the armour of our navy, and the material of our commercial marine—perhaps, too, the coating of our fortifications. Such conditions have been realised; but instead of the energy imparted by knowledge and experience, instead of the alacrity of anticipated triumph, they find among us error and bewilderment. Instead of pouring into our docks and arsenals a steady supply of impenetrable ship and armour plates, we are disputing about what is good iron, and are struggling to use what is not. Nevertheless, the impulse is given—ill or well the movement will go on—our wooden walls are rapidly transforming themselves into iron. The cost will be enormous. It depends on the direction for good or for ill now given to the iron manufacture whether the expenditure be not made in vain.

ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS, MANCHESTER.

At the last ordinary monthly meeting of the Executive Committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, May 27th, 1862, Thomas Schofield, Esq., in the chair. Mr. L. E. Fletcher, chief engineer, presented his Monthly Report, of which the following is an abstract:—

"During the last month there have been examined 316 engines and 464 boilers. Of the latter, 9 have been examined specially, 10 internally, 74 thoroughly, and 371 externally; in which the following defects have been found:—Fracture, 6 (3 dangerous); corrosion, 50 (7 dangerous); safety-valves out of order, 6; water-gauges, ditto, 15; pressure-gauges, ditto, 5; feed-apparatus, 1 (dangerous); blow-off cocks, ditto, 34 (2 dangerous); fusible plugs, ditto, 6; furnaces out of shape, 6—total, 129 (13 dangerous). Boilers without glass water-gauges, 29; without pressure-gauges, 10; without blow-off cocks, 34; without back pressure-valves, 33.

"Explosions continue to occur to every description of boiler. One has happened during the last month to a locomotive in the vicinity of London, and another to a stationary boiler on the Clyde. Both of these were—as it is hardly necessary to state—beyond the sphere of the operations of the Association. Each of these explosions was attended with fatal consequences, but I am not at present in possession of the engineering facts.

"The recent very frequent occurrence of explosions has monopolised, by the bare recital of their details, the entire space of the late reports, and left no room for considerations resulting from them, to which I think it is important attention should be drawn, and this, therefore, I now purpose to do.

"It will be remembered that one of the late explosions arose from the failure of an angle iron, on which alone—as on a single thread—a large crown plate depended for its support. Several other explosions occurred to externally-fired boilers through failure of the plates just at the seams of rivets exposed to the flame. In some of such cases the plate is found to crack at the rivet holes; in others leakage occurs, from which corrosive action sets in, and steadily continues until the plate becomes so thinned that rupture and explosion ensue. Some explosions have occurred from corrosion, consequent upon external damp; others, from acidity of the water; while others again, of somewhat earlier date, have been occasioned by the collapse of the furnace tubes, consequent upon the weakness of construction, which would have been remedied by the adoption either of flanged seams, T or angle-iron hoops, or other similar means.

"Thus it will be seen that all the above explosions occurred from the most simple causes, and that no mystery whatever need be attached to any one of them; while by suitable construction of the boilers in the first place, and due attention to their state of repair in the second, these explosions would in every case have been prevented.

"I am extremely desirous to keep this practical view of steam boiler explosions constantly in sight, since I am persuaded no head will be made against them generally as long as their causes are considered to be matters of mystery, and their occurrence one of chance.

"Very few of the explosions that come under my notice occur from shortness of water, and I believe that to be a much-abused idea, and the number of explosions resulting from it to be much exaggerated. It appears to be an almost stereotyped verdict at inquests, and the boiler attendant being frequently killed, there is seldom any witness to the contrary.

"I find that by far the most frequent cause of explosion is the insufficiency of the boiler for its working pressure, either on account of its original construction, or state of repair consequent upon use; while those explosions resulting either from deficiency of water, or from extraordinary or reckless pressure, are comparatively rare. In other words, to prevent misapprehension, I find that explosion is more frequently due to weakness of the boiler than to excessive pressure of the steam.

"I know no means of ascertaining the sufficiency of the original construction of a boiler, or of testing the weakness produced upon it by wear and tear—in short, of testing either new or old boilers—equal to the use of hydraulic pressure, and think all steam users would do well to make systematic use of this test once a year. In France, I believe, this plan is rendered compulsory by the Government, and it would be well were it generally adopted in this country voluntarily. Weak places in the plates may pass undetected, even on careful examination, while some parts may be inaccessible and concealed from view, but the hydraulic test is sure to detect and expose them all. Its timely application would have saved that most disastrous explosion which occurred some time since, here in Manchester, at a locomotive establishment second to none in the kingdom for its high reputation, and since a defect passed unnoticed at such an establishment, where the construction of boilers, as well as the quality and strength of plates may well be supposed to have been thoroughly understood, it surely argues the necessity of the hydraulic test being generally applied.

"Mr. Muntz, a steam user in Birmingham, states, in a letter published on the Millfield boiler explosion, that he has for years adopted, with advantage, the plan of an annual hydraulic boiler test, and considers it a duty he owes to his workmen in consideration of their safety.

"The application of the hydraulic test is so simple, and the pump required so small, that each steam user could provide himself with one at very little expense, or some parties might find it worth their while to take up the proving of boilers by water pressure as an itinerant speciality of engineering practice. This Association would be glad to assist in the general application of the hydraulic test, by inspecting the boilers when under pressure, and I feel convinced that, were the practice of this annual test generally adopted, which I trust it soon will be, explosions would become nearly, if not entirely, extinct."

YORKSHIRE UNION OF MECHANICS' INSTITUTES. — MEETING AT DEWSBURY AND BATLEY.

The twenty-fifth annual meeting of the above Union was held on the 22nd of April, the conference of delegates taking place at Batley, and the *soirée* at Dewsbury. There was an unusually large attendance of delegates from all parts of the country.

The conference commenced at eleven o'clock, in the Public Hall, Batley, Mr. E. Baines, M.P., the President of the Union, occupying the chair. Mr. Milnes, M.P., Mr. J. D. Dent, M.P., the Mayor of Leeds, and the Mayor of Halifax were also present.

The Chairman, after refering to the alteration of the period of holding the meeting, and observing that he was happy to see by the attendance, which was unusually large, that there had been no serious inconvenience caused by the change of day, said he thought he might justly congratulate the delegates and members of the Yorkshire Union on their having met to celebrate the 25th anniversary of the Union, and that they did so under circumstances of continued harmony and usefulness. They began with a very small number,—some who were on the platform, as well as himself, saw a meeting at which only thirteen Institutions in Yorkshire were represented a quarter of a century ago, and now they had in the Union 143 institutions, containing an aggregate of upwards of 25,000 members. The last twenty-five years had been a period of very remarkable prosperity, and of a degree of popular improvement and of intellectual and moral progress which had corresponded with the material prosperity of the country; and he thought that Mechanics' Institutions had contributed to, as well as shared in, this general improvement. They would all be very gratified to know that their Union also prospered, as well as the individual Institutes. During the past year, indeed, they had had a slight depression, caused by a decline in the commercial prosperity of the country; but that, they could not but hope, was altogether temporary, and would very soon be recovered.

Mr. J. Kitson, jun., one of the hon. secretaries, read the report, in which the Committee congratulated the delegates upon the fact of the Union having completed a quarter of a century of existence, this being the 25th annual meeting. The treasurer's report is substantially satisfactory, and shows that there is a good balance in hand, so that the question of finance does not interfere with the efforts of the Committee, and there is ample means for the extension of the operations of the Union. The flourishing state of the society's finances is, in a great degree, due to the labours of the agent and lecturer, Mr. Barnett Blake, who loses no opportunity for pressing the claims of the society on the friends of education, and who also transacts the current business with regularity and assiduity. Mr. Blake has delivered 51 lectures, attended 15 *soirées*, and paid 81 visits to Institutions for the purpose of giving advice and assistance. The following statement conveys a general idea of the position of the Institutions composing the Yorkshire Union :—

Summary of the Returns for 1862.

Number of Institutes in the Union		143
Total numbers of members estimated at		25,000
Reports received from Institutes		128
Number of members reported in 124 Institutes—Males	19,846	
Do. do. do. Females	2,430	
		22,276
Annual income of 106 Institutes		£12,160
Number of volumes in the libraries of 116 Institutes		137,250
Number of issues of books in 101 Institutes		307,836
Number of issues to each member		17
Number of books added during the year to 116 Institutes		5,944
(Being an increase of 4·5 per cent.)		
Number of periodicals taken n 113 Institutes :—		
Weekly	355	
Monthly	600	
Quarterly	60	
		1,015
Newspapers		979
Number of lectures delivered at 93 Institutes		504
Of which 117 were paid, and 387 gratuitous, and they have been classified as follows :—		
Scientific	112	
Literary	363	
Musical	29	
		504
In 83 Institutes, containing 18,473 members, the number of pupils belonging to classes is returned		7,658
In 79 Institutes, containing 12,371 members, the number of members belonging to the operative classes, dependent on weekly wages, neither clerks nor bookkeepers, is returned		8,719
(Being a proportion of 70·6 per cent.)		
Institutes returned as exempt from local rates		31
Do. not exempt, or only partly so		24

Comparative Table.

	1861.	1862.	Increase. No.	Increase. p.ct.	Decrease. No.	Decrease. p.ct.
Members in 120 Institutes	22,590	22,089			501	2·2
Do. 51 do.	8,601	9,861	1,260	14·6		
Do. 69 do.	13,989	12,228			1,761	12·6
Females in 79 do.	2,459	2,282			177	7·2
Income of 105 do.	£12,373	£12,151			£222	1·8
Periodicals 106 do. W	323	347	24	7·4		
M	562	568	6	1·1		
Q	58	60	2	3·4		
Newspapers	934	941	7	0·7		
Lectures at 79 Institutes — Paid	120	111			9	7·5
Lectures at 79 Institutes — Unpaid	423	345			78	18·4
Scientific	132	101			31	23·5
Literary	389	328			61	15·9
Musical	22	27	5	22·7		
Books in Libraries of 116 Institutes	131,306	137,250	5,944	4·5		
Issues in do. 94 do.	285,091	279,434			5,657	2·0
Pupils in Classes of 71 do.	6,966	6,911			55	0·8

The result of the comparison of these figures with those returned in former years is not very favourable. As compared with last year there is a decrease in every department, except in those of periodicals, books, and musical lectures. When the great efforts that have been made of late years to extend and to provide new buildings for Mechanics' Institutions are considered, and also when it is known in how many cases these efforts have been successful, it seems but natural to expect very different results. The numerous buildings that have been erected in the course of a few years have been provided by the liberality of the well-wishers of these Institutions, and in most cases have contained every necessary appliance and arrangement suitable for the object desired to be attained. The interest of the capital invested is equal to an annual donation of considerable amount, and in some cases is as much as 6s. 8d. per head per annum. This is a very large sum, and ought to be the means of placing the Institutions receiving it in the most prosperous position. The large Institutions in the Union maintain their position of usefulness. In a few cases they have made a slight advance, but the general course of the smaller Institutions has been retrograde. The explanations of this have in most cases referred to the general dulness of trade, and the consequent inability of operatives to pay the cost attendant upon their membership of an Institute. Many of the reports state that it is difficult or impossible to keep up the interest of lectures. It is not every place where gentlemen in sufficient numbers and of adequate ability can be found to give gratuitous lectures requisite to maintain the attractions of this form of instruction. The payment of competent lecturers, again, is quite beyond the means of many institutions, and, even where funds exist, it will often be found more useful to expend them in increasing the efficiency of the institution, in payment of teachers, or adding books to the library, than in lectures. It is, therefore, desirable that where good gratuitous lectures cannot be obtained, some substitute should be provided. Apparently one of the best that has yet been suggested is the plan of what is now becoming well known by the title of *Penny Readings*. This plan was originated at Ipswich, in 1859. It has been tried in one Yorkshire Institute—that of Masham—and the report speaks well, both of its success and of the "incitement given to young men to read and study the best authors, as well as the acquisition of a better style of language in which to clothe their own sentiments in conversation." In other institutions they have also been tried and proved very attractive. In consequence of an instruction from the last Annual Conference of Delegates, the Committee obtained returns from the Institutes for the purpose of ascertaining what proportion of the members of Mechanics' Institutions belonged to the operative classes. Out of 79 Institutes that have sent in replies, and which contain 12,371 members, the large proportion of 8·719 or 70·6 per cent. are operatives. This shows that the common statement that "Mechanics' Institutions contain no mechanics" is not well founded. It is, however, a matter of deep regret that so large a proportion of the population, whether operatives or otherwise, avail themselves of the advantages such institutions offer. It suggests the inquiry whether, as a preparatory step, and as supplementary to the existing Institutions, there should not also be Institutions less ambitious in their character, aiming less at instruction, and more at the recreation of those classes whom it is desirable to secure from the influence of the temptations to vice. An Institution called the Working Men's Institute has been opened, which is more calculated to meet the tastes of the working man than anything Mechanics' Institutes have yet endeavoured to accomplish—in fact it partakes more of the character of a club. The admission fee is one penny per week, which pays about half the expenses, the rest being raised by a few patriotic and public-spirited gentlemen. The numbers fluctuate considerably, according to the attractions provided, but there are generally from 700 to 1,000 members. In addition to a library, reading-room, and regular gratuitous lectures, there is a room for chess and draughts, where not less than 100 working men are playing every night. There is also a lavatory and smoking room, tea and coffee being supplied at one penny per cup. There are dramatic performances by amateurs, and free concerts. There is also a Penny Bank in connection with the Institution. The number of Institutes either possessing buildings of their own, or in course of doing so, continues to increase. The Hunslet Mechanics' Institution has now a very commodious structure, ready for the opening ceremonial, which has been erected at a cost of above £1,600. At Guisbro', through the munificence of Col. Challoner, Joseph Pease, Esq., and others, an excellent building for a Mechanics' Institute has been erected at a cost of about £600. At Marske, which possesses an Institute really efficient in class instruction, the liberality of the Earl of Zetland has provided a site and £200 towards a building, and the fund having been increased by Joseph Pease, Esq., and others to about £600, the Institute will shortly be second to none in the country, in proportion to the population of the place. Even Appleton Wiske, a small village near Northallerton, will shortly have a building for its Institute in a style suited to its limited means. With such enormous examples of public spirit, it is not fitting that the capital of the West Riding should be left behind in the race, and it is therefore gratifying to notice that the Committee of the Leeds Mechanics' Institution are making strenuous exertions to obtain the necessary funds for the erection of a building suited to their requirements. It will comprise ample accommodation for the School of Art, in addition to a spacious lecture-hall and other rooms. The Committee have determined not to commence building until the sum of £10,000 has been raised, and it is hoped that the liberality of the public will very soon supply the small additional sum required to make up the amount.

Mr. B. Blake, the agent and lecturer of the Union, then read his report, in the course of which he observed:—"During the season just closed I have delivered about fifty lectures; and, confirming my previous experience, I have found those of an amusing character to prove the most attractive. They have not, however, been without their uses in increasing the attendance, and thereby affording a wider field in which to advocate the claims of the Institute to public support. It is a common complaint that, in very many instances, the attendance at lectures is uncertain, and almost too small to justify the committee in incurring the necessary outlay. If the advantage of having lectures be limited to the simple test of whether they will pay, there can be little doubt that, in perhaps the majority of cases, they bring rather loss than profit. This is scarcely, however, a fair criterion by which to judge of their effects; they should be followed by increased attention to the subjects on which they treat; and they also serve to give additional publicity to the existence, the advantages, and the operations of the Institute—a point which has been too often neglected. Much, however, of the failure of lectures, as a means of usefulness, may be attributed to their desultory character, in many Institutes being delivered at long intervals, requiring special announcements, and, of necessity, involving additional expense with fewer equivalent results."

Mr. J. H. Shaw proposed the following resolution:—"That this meeting desires to record its sense of the heavy loss which Mechanics' Institutions, in common with the other educational bodies in the kingdom, have sustained by the decease of the late deeply lamented Prince Consort, by whose support and encouragement their progress has been greatly promoted, and whose memory they, in common with the rest of her Majesty's subjects, hold in the highest honour."

This was unanimously adopted.

Various subjects were then discussed, and a complimentary vote passed to Edward Baines, Esq., M.P., for his valuable services as President of the Union, and for his conduct in the chair.

An evening meeting was also held, at which R. Monckton Milnes, Esq., M.P., presided.

PAPER MANUFACTURE.

The Special Catalogue of the Austrian department of the International Exhibition is printed on paper in which maize fibres form the principal material. The following letter, in reference to the remarks in Mr. Hawes's paper on the Exhibition, has been received from Professor Arenstein, member and chief reporter of the Imperial Austrian Commission:—

"International Exhibition, 1862.
"10th June, 1862.
"15, Brompton-row, London, S.W.

"Sir,—Permit me to draw your attention to an ambiguity contained in the very interesting paper of Mr. Wm. Hawes, "On the International Exhibition of 1862," which appeared in the *Journal of the Society of Arts*, of the 30th May. In reference to paper manufacture, Mr. Hawes says:—"It may be interesting to mention that the Austrian catalogue is printed on paper made from maize fibres, mixed with cotton and linen rags; the French catalogue on paper made from maize and cotton rags." These lines may lead to the conclusion that the catalogue of the French exhibition is printed on paper made from maize and cotton rags, while the intention of Mr. Hawes was certainly to mention the fact that the English, French, and German editions of the Austrian catalogue are printed on three different kinds of maize paper, viz., the German edition on paper consisting of maize fibres and linen rags, the French on paper of maize fibres and cotton rags, and the English edition on paper produced from maize fibres and linen and cotton rags.

"I will thank you to insert this explanation in the columns of your *Journal*. "I am, &c.,

"JOSEPH ARENSTEIN.

"To the Secretary of the Society of Arts."

The following remarks are taken from the Preface to this Catalogue:—

"Where shall we in future get our paper from, if the consumption of paper increases in the same ratio as hitherto, and rags are perpetually becoming dearer? This is the question long since asked not only by paper manufacturers, but also by those for whom the prices of paper are of vital importance. Since *rags* cannot be produced at pleasure like many another raw material, we must direct our attention to a substitute that may answer the natural laws of supply and demand. Such a substitute is found in the maize plant. This plant affords excellent paper, whether its fibrous substance be intermixed with rags or not. In this catalogue we offer specimens of both pure and mixed maize-straw paper, the German catalogue being printed on paper consisting of maize fibres and linen rags, the French on paper prepared of maize fibres and cotton rags, the English on such as is produced from maize fibres, linen and cotton rags. The paper of the German catalogue is white; that of the French blue; and that of the English yellow, in accordance with the wish of the Commission. The covers of the French and the English catalogue are of the same paper, but thicker than that of the catalogue itself; whereas the cover of the German is made merely of maize fibre stuff. The present notice is, in all three catalogues, printed on pure, bleached maize fibre material almost entirely cleansed from its gluten. This sample shows that pure maize straw paper is characterised by a great degree of transparency. As exhibited in the octavo leaf bound up with this catalogue, the before-mentioned quality, among others, renders it excellent for tracing tissue paper; and this transparency being natural, such tracing tissue paper can be produced cheaper than any other artificial one. The maize fibre paper is also peculiarly suitable for lithographic purposes.

"By reason of the fibrous substance of the maize plant being endowed with extraordinary tenacity, it is especially to be recommended, like parchment, for documents and deeds. Maize straw paper resists the influences of time even more effectually than parchment, the gluten contained in the maize plant being better qualified than any other known material to resist putrefaction. Maize paper is, therefore, much less subject to decomposition than parchment, which consists of organic animal matter. As to the cost of production of maize straw paper, it would exceed that of paper manufactured of rags, if there had not recently been discovered a quality in the maize fibre, securing to it a far better means of converting it into use than by working it up into paper, viz., that it can be spun and woven like flax and hemp. This discovery has already passed the experimental stage, for there exist already establishments in Vienna and Schlöglmühle, near Gloggnitz, where maize flax, as it is called, is spun and woven in considerable quantities. The process of producing maize flax is the inventor's secret, and patented in all great states of Europe; but all patents not yet being in his hands, productions of his new invention could not as yet be sent to the Exhibition. What renders maize flax weaving highly advantageous, is, that the worst waste of maize straw yields excellent paper, which is sufficiently proved by the paper manufactured of such waste and made use of for printing the present catalogue on."

EXTRACTS FROM THE REPORTS OF H.B.M. CONSULS.

(Continued from page 153.)

San Sebastian, Spain.—This province produces various rich ores, zinc ones especially—such as calamine and blende. The former is appropriated (as far as the croppings go) by the Royal Austrian Mining Company for its manufactory at Aviles, and 750 tons of the latter, containing about 40 per cent. of zinc, were exported to Belgium in the course of 1856. Numerous productive-looking veins of calamine and copper, although duly registered by their discoverers in conformity with the Spanish law upon mines, remain unworked, principally because land-carriage is so costly and insufficient; but according to official data before me, it seems probable that blendes, calamines, and galenas, will be shipped in rather considerable quantities. Coal has not yet been found, and the iron ore is of such inferior quality, that on an average, 3,000 tons of that mineral are annually imported from Biscay by undecked coasters, for the manufacture of the justly-celebrated fire-arms and other iron-work of Guipuzcoa. Since the termination of the Carlist war the industrial progress of Guipuzcoa has been rapid, and it now possesses four cotton, two cloth, four paper, two fire-arm, one anchor, two nail, two soap, one porcelain, one glass, and two composition-candle manufactories, besides an iron foundry, and sixty large forges. The cotton goods manufactured are "retortas" and "elefantinas" (domestics), together with printed calicoes,

Santander, Spain.—Santander, a seaport town on the coast of Cantabria, bordering the Bay of Biscay, is situated in latitude 43° 28′ 20″ and longitude 0° 0′ 4″. It has a large open harbour or bay, by which it is bounded on the south, and the place is, consequently, much exposed to the strong gales of wind which blow from that quarter, and prevail in certain seasons of the year, particularly during the autumn. On the north the place is protected by a small ridge of hills which begins to rise at the entrance of the port, and continues for about six miles in a westerly direction. The town is built at the distance of 1¾ mile from the entrance into the harbour. On the south side of the above-mentioned ridge of hills, and the old part of it, stands upon a bed of ground of a calcareous and argillaceous nature, similar to what is to be found in all the surrounding districts. The population of Santander, which is the capital of the province of the same name, is reckoned to be 20,000. The port is of good depth, capacious, and safe, and has good holding-ground. It is likewise of easy access for ships of any burden, at high tide. The rivers Cubas and Fijero, and a small stream from Solia, formed by the natural drainage of the upland, and mountains on the south, and eastern sides of the harbour, flow into the latter, but are navigable only for a very short distance by small craft. Not far from the entrance, towards the west, on Cape Mayor, there is a light-house with a revolving light, established upon one of the most recent and improved systems of modern invention. Another light-house, though of smaller size, is in course of erection, and it is expected will be shortly built on a rock called Pena de Mogro, at the very entrance of the harbour. The works for the cleaning of the port are carried on by means of two dredges driven by steam, and the luggers or barges which they fill with mud and sand raised from the bottom, are also taken away by a steam-tug to different places. A new mole, undertaken by private enterprise, has been begun of late years on the western side of the bay, and a wall of dry rubble is being built for the purpose of cutting away a portion of land which is covered by the water at high tide, and which will become the property of the contractors when finished. The direction of the wall is almost perpendicular to the quay and old part of the town. It runs towards the south, and will be 5,518 metres in length; the space of ground cut away by it measuring 538 hectares, and 28 ares. Close to the town, and in this new made ground, is the station of the Ysabel second railway, which is to join Alar del Rey and Santander about 70 miles from each other, will be built. The third of the section into which the whole line has been subdivided, viz., from Alar to Reinosa, a length of 27 miles, is on the eve of being opened to the public, and a few experimental trips have already been made on it. The produce of the province of Santander is principally Indian corn, or maize, and what is collected is barely sufficient to meet the wants of the inhabitants. Other kinds of grain are likewise cultivated, but in such small quantities, that it is not worth mentioning them. The flour consumed by the people and that bought for exportation, comes from the interior of the country, chiefly from the mills or corn-factories situated on the canal of Castile, which runs from Alar del Rey to Valladolid. It is transported in carts drawn by bullocks, and the carriage is both bad and expensive, not only on account of the length of time employed in bringing it to Santander, but likewise owing to the bad state and condition to the corn is brought in the carts, which are open conveyances, or at most badly covered. Hence, too, the reason why so many cattle being necessary for the traffic on the roads, such great quantities of hay are required, the landowners allowing grass to be grown in their fields in preference to corn. The regular trade of Santander is almost entirely with the island of Cuba, to which island the flour from Castile is principally exported, bringing in return sugar, coffee, and rum; cocoa or cacao from La Guayra, and a few shipments of fish from Norway, Newfoundland, and Shetland; timber, planks, and also hides, oil, and rice, from the South of Spain, form the articles of commerce, though in small quantities compared with other substances required for human food. When there are bad harvests in other countries, it has been observed that trade becomes brisker in Santander, particularly in the exportation of flour, which is then brought down in large quantities from Castile. At present, also, great activity prevails in this branch of commerce, though contrarily to its natural course, the corn being brought from France and England for importation into Castile, as the granaries in the latter part of Spain became nearly exhausted during the last years, owing to the large quantities that were exported to the two former countries. Since the line of steamers has been established, plying direct from Santander to Nantes, and likewise between the former port and Bayonne, Liverpool, and Hamburgh, calling occasionally at other places, such as Southampton, other classes of merchandise are received, principally silk, cotton, and woollen goods, also chemicals, drugs, and machinery, but almost wholly for the interior of Spain. According to the returns of trade, the value of such different classes of articles ascended in the year 1856 to £591,885 sterling, it being scarcely possible to certify the weight, measure, and contents of each bale, owing to the circumstance of their having been imported as transit goods, and, consequently, valued in a lump. One of the great articles of commerce in this province, (Vigo, Spain,) is the pilchard (Sardinian). The quantity of this fish caught on the coast, and in the bays along the coast, was much greater a few years ago. At present it may be reckoned that 600,000,000 are caught yearly; of which 200,000,000 are consumed in the province fresh or slightly cured, whilst 400,000,000, or 20,000 casks, weighing 12 quintals each, are salted and exported, chiefly coastwise, to ports in the Mediterranean, or on the north coast of Spain, some being exported to the Spanish colonies, to ports in South America or to Sicily. In this branch of industry alone, the value of 20,000 casks of pilchards exported may be estimated at 600,000 dollars, equal at par to £120,000, and the 200,000,000 retained for consumption in the province amounts to 60,000 dollars, or £12,000, making together a yearly product of 660,000 dollars, or £132,000. The last season the fishery of the pilchard has been very abundant, and its value may be estimated at 1,210,000 dollars, or £242,000. The oil of this fish also forms an article of commerce, and 10,749 gallons were exported in 1856. It is also consumed in the country by the lower classes for lighting, and the lees are purchased for tanneries. At Tubia, near Ferrol, are the splendid copper works belonging to the Spanish Government, where copper coin was cast about four years ago. It is now employed in the manufacture of copper in sheets and nails furnished to the royal arsenal at Ferrol, and also sold to the trade generally. The copper ore is the produce of the mines of Rio Tinto, in Andalusia.

Home Correspondence.

" A NEW MOTIVE FORCE."

Sir,—A paper appeared in No. 494 of the *Journal*, by Dr. Meschin, on a " new projectile force," and he alludes also to a " new motive force." Two correspondents have made some remarks chiefly on the " projectile force," but it is perhaps owing to the fact that the " new motive force" is treated of only subordinately, that it has escaped the attention of many of your readers, far more competent to deal with such a subject than your present correspondent; but there are certainly some parts of the communication that ought not to pass unnoticed, as they have appeared in a *Journal* with so great a circulation, and possessing so much authority and influence with numbers of practical men, who probably have not the opportunity of following the more technical and scientific (but not the less real) bearings of the subject. It is to this " new motive force" alone I wish to draw attention.

Dr. Meschin's are evidently only hypothetical machines, and every one who has devoted any attention to such topics, has no doubt quickly discovered the very great difference between drawing up such a general scheme on paper and the practical carrying out of such a design in a working engine. One of your correspondents apologises for designating " Mr. Meschin's proposal a theory because every position assumed by that gentleman has separately passed through the ordeal of practical demonstration by eminent men." While discussing even the unbending laws of nature, it is no doubt policy (to put it in no stronger light) to pay the strictest attention to the laws of courtesy and good fellowship in alluding to writers whose views are being canvassed; but in the sentence quoted above, is not truth sacrificed (no doubt unwittingly) to the natural wish to wind up the note with a compliment? To commence with what may be designated—for the sake of easy reference—the four axioms with which Dr. Meschin starts (vide page 410), what " eminent man" has " practically demonstrated" the decomposition of water by frictional electricity, or even by thermo-electricity, except in minute quantities, which are quite out of the question in the present case? Allowing, however, the possibility of such a decomposition in quantity by friction, or as it may no doubt be done by magneto-electricity, there must be a motive power to start with, and doubtless the cheapest available method would be the use of steam power, as in the case of the North Foreland Lighthouse, where a steam-engine was used to produce the electric light through the agency of magneto electricity. If this be so, it therefore follows that Dr. Meschin's second and third axioms cannot be rendered available for the economical production of a " new motive force," unless in some part of his circuit of operation he manages to get to the " blind side" of nature, and induces her, by his manipulations, to give him a larger amount of force than the experience of all other investigators has led them to think can be produced; for no law of physical science has been more clearly or more fully established, both by mathematical and experimental demonstration, than this—" an equivalent of matter in changing its form will produce an equivalent of force," and no more, whatever ingenious devices may be brought into operation. The delicate experiments of Joule, and the elaborate mathematical and experimental researches of Professor W. Thomson, not to mention other eminent physicists, have fully demonstrated the correctness of these views, as old, at least, as Liebig's earlier publications, and ably put forth many years since by Grove, in his " Correlation of Physical Forces." Any inventor who ignores this law will certainly do so to his disappointment and loss, and the shelves of the Patent Office contain many recent instances of this, so that it may be useful again to draw attention to it. The law just alluded to must also set aside the economical use of voltaic electricity as the source of the " new motive force." This may most certainly be affirmed in the present state of science, and it is difficult to conceive of any modification or improvement of the galvanic battery which can enable it to compete with coal as the source of mechanical power. The point alluded to at page 414, " If some method could be discovered of making the products of the battery nearly as valuable as the zinc, or other agent used, the great problem would be solved," has not escaped more practical investigators, and it has been the subject of more than one patent. Dr. Watson's appeared to be the most hopeful, and excited some attention ; it was taken up by a public company, but appears to have been a failure. This objection to the application of electricity, as a source of motive power, has been repeatedly brought before the public in connection with electro-magnetic machines. Professor Hunt read a paper before the Society of Arts on the subject in 1851, and although Dr. Meschin may reply that his "new motive force" is a very different thing from electro-magnetism, he will find it a very difficult task to expect men of science to believe for a moment that his proposed method for developing motive power is not subject to the above law.

At page 414, Dr. Meschin says, "The proposed electric gas engine and electric gas gun are original ideas." Dating from Chancery-lane, it is a wonder the writer has never thought of taking a two minutes' walk just to look into that repository of "original ideas," the Patent-office. If he had done so, he would have had little trouble in finding out that his ideas have been embodied in many patents, some nearly ten years old ; there is one as long since as 1840, which I think will be found nearly akin to it ; but as the office is open to all, and all the patents connected with electricity, up to a recent date, are tabulated in a separate volume, so that any one interested in the matter can in five minutes see for himself, it is needless to be more explicit at present. I think it is No. 575, A.D. 1853, which looks very much like a perpetual motion machine, in which Grove's gas battery is transplanted from the philosophical laboratory (where it has been hitherto almost a scientific curiosity or toy) to the engine-room of the mechanic to supersede the steam engine. This proposed engine, if I recollect rightly, was referred to at the time with commendation, and in terms of large expectation, in "Timbs' Year-Book of Facts," a popular volume by an author of some repute, and therefore it is the more to be regretted that some wild schemes are annually chronicled by it as "facts" without apparently the slightest discrimination as to their usefulness or even practicability. I am, &c.,

W. SYMONS, F.C.S.

17, St. Mark's-crescent, 10th June, 1862.

RECREATION IN MECHANICS' INSTITUTES.

Sir,—If Institutes designed especially for working men are to prove really efficient in influencing for good the great majority of our industrious population, the provision of amusement for leisure hours and occasional holidays must form an element, and that not the least in their operations. Relaxation from the toils of labour may differ in kind and in degree, according to the nature of the employment and its ordinary effects upon the bodily frame, but in almost every case something is required which may be characterised and felt as real enjoyment, and much will depend upon the mode in which it is carried out, for its influence proving beneficial or otherwise. One of the strongest objections to the early closing movement was the belief—perhaps too well founded—that many would occupy the coveted leisure in dissipation and intemperance, whilst the demand for occasional public holidays, in order to lessen the desecration of the Lord's Day, was met by a similar objection.

If, however, the managers of the Mechanics' Institutes were to devote their serious attention to the best means of rendering such intervals really profitable, not only would such objections be removed, but the arguments in favour of occasional public holidays would be materially strengthened. The men have by their labour acquired the right to spend the wages of their industry, and while they will execute this right according to their own will, it more often depends upon the judicious guidance of others, and the systematic organisation of a local Institute, whether the recreation shall prove a bane or a blessing. As most Institutions are at present constituted, they offer the instruction to be afforded by classes, library, reading-room, or lectures, and if these be not appreciated, which by the majority they are not, the working classes are at once condemned for being insensible to all attempts for their mental and moral improvement. The charge may be true to a certain extent, but it is too often owing to the little endeavour which has been made to give the amusements of our working people a profitable direction.

In country towns during the summer months much good may be done by having a cricket club as a part of the Institution, the bats, balls, &c., being provided, and proper order as well as attendance, to give interest to the game, being secured by rules. In places near a broad river, rowing forms a healthful recreation, and small prizes may occasionally be awarded to the successful in competition. In other places—for much will depend upon the nature of the locality—there may be foot-races and athletic sports such as Englishmen delight in, and if under the auspices of the Institute, small fines might be levied for foul language and other intemperate conduct.

It is, however, in the long evenings of winter, when the public-house proves the strong temptation to so many, that a counter-attraction is the most needed. It is then that the Institute should strive the most to bring all within its influence, and by adapting its offered advantages to the feelings and inclinations of those whom it seeks to collect within its walls, obtain that appreciation the absence of which is now so much lamented. In the North of England especially, and in most other parts, music, both instrumental and vocal, rarely fails to prove attractive ; and whilst much advantage is gained from large numbers, the working-man has only the public-house concert unless the Institute provides a similar entertainment.

It is gratifying to observe, from the letter of Mr. Jones, of Dudley, that some attempts in this direction have been made amongst the numerous population engaged in the collieries and iron-works of South Staffordshire, and that so far they have proved successful. It is by such persons that relaxation is most needed, their labour being exhaustive of their physical energies ; but there are many others, with less excuse for such indulgence, who can only be influenced by similar means. But even entertainments ostensibly and chiefly for amusement need not be entirely so. The glee, or the chorus, or the song, or the overture, may alternate with the reading of something more instructive, and the word in season may often be productive of future fruits though immediate results may not be always apparent.

It may be argued, as it has often been, that Mechanics' Institutes are for the promotion of literature and science, and that the encouragement of mere amusement is beyond their province as well as a lowering of their character. This may be true, but on the other hand, if learning and its manifold advantages have no charms for the working man for whom the means of self-improvement have been provided, is it not true wisdom, if the end sought be the improvement of the uninstructed, the teaching of the untaught, to seek it by the best means that may be attainable? The working man, however ignorant, or oblivious of his own good, is a free agent, and if he will not be tempted within the walls of the Institute by the useful which has been provided, it is certainly deserving of consideration whether, by the more attractive nature of the advantages offered, he may not be gained to take the first step to his moral amelioration by forsaking the public-house.

If our working population were once brought within the influence of the Institute by inducements to become members, many opportunities might be found for improving the acquaintance. In the society of better informed men, ignorance might become ashamed of its own inferiority, and be stimulated to better aspirations. It is in the company of their equals or inferiors that men fail to acquire any desire to become better, but as even cowards fight courageously in brave company, so intellectually the same spirit to emulate their fellows may be excited if they are brought in association within the Institute, where mental cultivation has ostensibly a prominent place.

Let me hope that this subject may be still further elucidated at the approaching Conference at the Society of Arts. I am, &c.,

BARNETT BLAKE.

Leeds, 7th June, 1862.

THE PATENT LAW.

Sir,—I was much pleased to see the letter on this subject by Mr. Campin, inserted in the *Journal* for May 16th, page 444, because it confirms or corroborates every position assumed by me in regard to the law of patent right, and I only beg a small space in order to point out one or two errors which I find in that gentleman's communication.

It may possibly be the case, as Mr. Campin asserts, that Sir W. Armstrong found out the same thing, that is to say, a mode of manufacturing heavy ordnance with wrought iron, for which Sir William obtained a patent in 1858; but it should be observed that the same process was described and published by me in this *Journal*, in the number for December 15th, 1854, some three or four years before the date of Armstrong's patent.

Mr. Campin is in error when he supposes that Government had forgotten my invention, which was laid before the Board of Ordnance in January, 1856, because from that date to the present time, there has been a constant correspondence kept up on this subject between the Board of Ordnance, the War Office, and myself; and I have a petition now lying before Parliament praying for acknowledgment or compensation for the injury I have sustained.

Mr. Campin further presumes, very erroneously, that I could not stand any amount of "badgering" from Government officials. What I could not stand was the risk and expense of a patent right lottery ticket, or, still less, that of constructing, at my own proper cost and charge, a full-sized ten-inch piece of ordnance for trial and proof by the experimental committee of the Royal Arsenal at Woolwich.

Finally, I beg to say that I did acquire *status* by laying the whole process before the Ordnance Select Committee, in whose possession the plans and process still remain.

I am, &c., HENRY W. REVELEY.

Parkstone, Poole, Dorset.

MEETINGS FOR THE ENSUING WEEK.

Mon......British Architects, 8.

Tues. ...Statistical, 8. 1. The Rev. Edward Gillett, "A Plan for the Collection of Agricultural Statistics." 2. Mr. Jno. Glover, "On the Statistics of Tonnage during the first decade under the Navigation Law of 1849."

Architectural Museum, South Kensington, 8. The Rev. Thomas James, M.A., "On Labourers' Cottages and their bearing upon Architecture."

Ethnological, 8. 1. Mr. John Crawfurd, "On Colour as a test of Race." 2. Mr. R. S. Poole, "On Egyptian Ethnology."

Wed. ...Meteorological 7. Annual Meeting.

Geological, 8. 1. Professor J. B. Jukes, "On the Mode of Formation of some of the River-valleys of the South of Ireland. 2. Rev. Professor S. Haughton, "On the Granites of Donegal." 3. Mr. E. W. Binney, "On the Upper Coal-measures of Ayrshire." 4. Professor James Nicol, "On the Geological Structure of the Southern Grampians." 5. Mr. S. H. Beckles, "On some Footprints in the Wealden of the Isle of Wight, Hastings, and Swanage." 6. Professor T. H. Huxley, "On a Stalk-eyed Crustacean from the Coal-measures."

Thurs...Royal, 8½.

Antiquaries, 8½.

Linnæan, 8.

Chemical, 8.

Numismatic, 7. Annual Meeting.

Philosophical Club, 6.

Fri.......Royal Inst., 8. Professor Faraday, "On Gas Glass Furnaces, etc."

R. Horticultural Soc., 2.

Sat.......Asiatic, 3.

PARLIAMENTARY REPORTS.

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SESSIONAL PRINTED PAPERS.

Delivered on May, 15*th* 1862.

Par Numb.

186. Schools—Returns.
204. Coals (Woolwich and Portsmouth)—Return.
220. Public Accounts—First Report from Committee.
227. Navy (Pursers)—Return.
111. Bills—Crown Private Estates.
113. " Universities (Scotland) Act Amendment.
114. " Local Government Supplemental.
115. " Elections for Counties (Ireland).
116. " Elections (Ireland).
117. " Public Houses (Scotland) (as amended in Committee, and on re-commitment).

Rebellion in China, and Trade in the Yang-Tze-Kiang River—Maps.

Delivered on 16*th May*, 1862.

228. Ecclesiastical Commission (Ireland)—Annual Report and Account.
236. Government Property—Return.

Copies of the undermentioned Papers, presented by Command, will be delivered to Members of Parliament applying for the same at the Office for the Sale of Parliamentary Papers, House of Commons:—

30. Poor Relief (Ireland)—Annual Report.
31. Charitable Donations and Bequests (Ireland)—Seventeenth Report.
32. Convict Prisons (Ireland)—Eighth Report.
33. Turnpike Trusts—General Report from Secretary of State.

• *Delivered on* 17*th and* 19*th May*, 1862.

232. Tyrone Assizes (Jury Panel)—Return.
210. Canada (Halifax, &c. Railway)—Copy of Official Communications, &c.
240. Metropolis Local Management Act—Return.
250. Civil Services—Supplementary Estimate (Class 4).
251. Civil Services—Supplementary Estimate (Class 5).
47. Bills—Fisheries (Ireland).
121. " Universities (Scotland) Act Amendment (No. 2).
122. " County Surveyors (Ireland).

Occupation of Lagos—Papers.

Delivered on 20*th May*, 1862.

213. Exchequer—Account.
221. Fires in the Metropolis—Report and Evidence.
239. Longford County Election—Returns.

Delivered on 21*st May*, 1862.

61. Local Acts—Admiralty Report.
235. Metropolis Turnpike Roads—Thirty-sixth Report of the Commissioners.
242. Queen's Colleges (Ireland)—Returns.
243. Limerick Mail—Copy of Correspondence.
253. Army (Cast Horses)—Return.
254. Military Survey (London)—Return.
160. Sewage of Towns—First Report from Committee.
119. Bills—Salmon Fisheries (Scotland) (amended)
123. " Education of Pauper Children (amended by the Select Committee).

Delivered on 22*nd May*, 1862.

223. Highways Bill—Minutes of the Proceedings of the Select Committee.
234. Galle Harbour (Ceylon)—Return.
246. Tea, Coffee, &c.—Return.
247. Sugar Duties—Copy of a Memorial.
252. Civil Services—Supplementary Estimate (Class 7).
215. East India (Paper Money)—Return.
120. Bills—Lunacy (Scotland) (amended)
124. " Unlawful Oaths (Ireland) Act Continuance.

France—Convention relative to Joint Stock Companies.

Delivered on 23*rd May*, 1862.

230. East India (Covenanted Civilians)—Return.
238. Tobacco—Return.
241. Queen's Colleges (Ireland)—Return.
127. Bills—Artillery Ranges.
128. " Sandhurst Vesting.
129. " Jurisdiction in Homicides.
130. " Inclosure (as amended by the Select Committee.)

United States of America—Treaty for the Suppression of the African Slave Trade.

Education—Minute of the Committee of Council confirming the Alterations of the Revised Code of Regulations.

Session 1861.

324 (C.) Poor Rates and Pauperism—Return (C).

Delivered on 24*th and* 26*th May*, 1862.

248. Industrial Schools—Returns.
262. Navy—Return.
264. Royal Dublin Society—Return.
265. Railway and Canal Bills—Seventh Report from the General Committee.
267. Church Building Acts, &c.—Return.
214. East India (Sikkim Expedition)—Return.
266. East India Communication—Report from Committee.

126. Bills—Partnership Law Amendment.

134. „ Rifle Volunteer Grounds Act (1860) Amendment.

86. „ Juries.

Public General Acts—Caps. 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21.

Delivered on 27th May, 1862.

260. Licensed Trades and Professions—Return.

261. Military Reserve Fund—Account.

269. Pier and Harbour Act—Report of the Board of Trade.

132. Bill—Clergy Relief (as amended by the Select Committee).

Mexico—Correspondence (Part 2).

Delivered on 28th May, 1862.

229. Railways—Return.

258. Landed Estates Court (Dublin)—Return.

263. East India (Bengal Army)—Return.

268. Children in Workhouses—Return.

277. Spithead Forts—Paper.

125. Bills—Tralee Savings Bank.

135. „ Highways (as amended by the Select Committee, and in Committee.)

Delivered on 29th May 1862.

272. Militia (Ireland)—Returns.

273. Holyhead and Kingstown Mails—Return.

275. East India (Military Letter)—Return.

133. Bills—Police and Improvement (Scotland) (amended).

136. „ Merchant Shipping Acts, &c. Amendment (amended in Committee, and on re-commitment).

138. „ Police (Counties and Boroughs).

Delivered on 30th May, 1862.

256. Canada (Mr. Ryland's Claims)—Return.

276. National Defences—Return.

139. Bill—Salmon Fisheries (Scotland) (as amended in Committee, and on re-commitment.)

North America—Despatch from Lord Lyons respecting the Reciprocal Treaty (No. 10).

China—Further Papers relating to the Rebellion.

Delivered on 31st May and 2nd June, 1862.

43 (4.) Trade and Navigation Accounts (30th April, 1862.)

274. Trade of Certain Ports—Accounts.

278. Lunacy—Return.

280. Middle Level Drainage—Return.

283. Railway and Canal Bills—Eighth Report from the General Committee.

190. Wine—Return.

257. Transatlantic Steamers—Return.

218. Railway and Canal Bills—Ninth Report from the General Committee.

291. Army, &c.—Account of Receipt and Expenditure.

294. Public Expenditure—Returns.

118. Bill—Tramways.

Delivered on 3rd June, 1862.

30. Railway and Canal Bills (154. Kent Coast Railway)—Board of Trade Report.

284. Vessels and Tonnage, &c.—Return.

212. Trade Marks Bill and Merchandise Marks Bill—Report from Committee.

233. Prisons—Return.

244. East India (Finance and Revenue Accounts)—Paper.

137. Bills—Companies, &c. (amended).

142. „ Ballot.

143. „ Naval and Victualling Stores.

144. Parochial Assessments (as amended by the Select Committee).

Denmark (Surrender of Prisoners)—Convention.

France (Naval and Military Forces—Copy of Reports.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 6th*, 1862.]

Dated 17th April, 1862.

1116. A. Krupp, Essen, Prussia—Certain imp. in the manufacture of screw propellers.

Dated 29th April, 1862.

1247. J. W. Caley and F. G. Caley, New Windsor—An improved textile fabric.

Dated 2nd May, 1862.

1299. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for superheating steam. (A com.)

Dated 9th May, 1862.

1387. G. F. Greiner and J. H. C. Sandilands, 1, Golden-square—Imp. in the construction of pianofortes.

1388. T. McIlroy, 260, Oxford-street—An improved invalid bedstead.

1391. W. Eddington, jun., Chelmsford, Essex—Imp. in portable grinding, chaff-cutting, and corn-crushing machinery.

1392. F. F. B. Mayall, Warrington, Lancashire—Imp. in dyeing mixed or plain fabrics and yarns.

Dated 13th May, 1862.

1443. W. Clark, 53, Chancery-lane—Imp. in apparatus for generating motion in fluids, applicable for raising and forcing water, propelling and otherwise in the distribution of motive power. (A com.)

Dated 14th May, 1862.

1451. H. C. R. Joubert, 18, Maddox-street—Imp. in raising music chairs, stools, or seats.

Dated 16th May, 1862.

1486. F. B. Anderson, Birmingham—Imp. in watches and other time keepers.

Dated 19th May, 1862.

1512. F. C. Kirkman, Crouch-end, Hornsey, and R. Swift, Hounslow—A new and improved joint for uniting or fixing posts and rails of bedsteads and other articles of furniture, posts, and rails in fencing, in the construction of framework for conservatories, emigrants and other portable houses.

Dated 22nd May, 1862.

1542. E. De la Bastida, 43, Hart-street, Bloomsbury-square—A new process for the production of designs in relievo, and in deepening on sheets of india-rubber of any length whatever. (A com.)

1544. J. Needham, Piccadilly—Imp. in breech-loading fire-arms, and in cartridges for such fire-arms.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1646. J. Betteley, Liverpool—Imp. in ship building, and in rendering ships shot proof.—31st May, 1862.

PATENTS SEALED.

[*From Gazette, June 6th*, 1862.]

June 6th.

3083. R. A. Booman.

3087. W. Clark.

3093. J. A. J. Reider.

3099. D. Vogl.

3109. J. Potter.

3110. J. Leeming.

3113. W. Lightfoot.

3118. A. Tonnar.

3129. J. W. Friend.

3133. P. Quantin.

3137. H. Appleby & H. Harrison.

3245. J. McIntyre.

339. A. V. Newton.

841. W. L. Winans.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, June 10th*, 1862.]

June 2nd.

1354. S. Wood, J. Wood, and P. Billington.

June 4th.

1383. J. Ferrabee.

1466. J. Combe and R. Smalpage.

June 5th.

1384. W. Green.

1400. A. V. Newton.

1407. M. J. Haines.

1425. A. Smith.

1431. W. Brown and S. Bathgate.

June 6th.

1423. H. L. Corlett.

June 7th.

1394. J. Henderson, W. Henderson, T. Bagley, and S. Holdsworth.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, June 10th*, 1862.]

June 3rd.

1274. G. Green.

June 5th.

1292. G. Hopper.

1294. J. Robertson.

1299. J. Ramsbottom.

1300. J. Buncle.

1318. C. F. Varley.

June 6th.

1315. J. S. Nettlefold, E. J. Nettlefold, and J. H. Nettlefold.

1321. J. Robinson.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Name.	Address.
4483	May 17.	New or Improved Target for Percussion Cap Practice...	Richard George Coles	Fleetwood.
4484	June 3.	A Compound Protractor	Commander Hay, R.N., & J. R. Stebbing, F.R.A.S.	Southampton.
4485	„ 4.	A Compound Collar and Cravat, to be called the "Olympic."	Robt Furness and Ed. Furness.	11, Trump-street, City, E.C